WHAT IS CLAIMED IS:

1. A magnetic bearing device comprising:

a rotor;

position control means for controlling at least one of a radial position and an axial position of the rotor by electromagnets;

first voltage generating means for generating a first voltage between a first positive electrode and a negative electrode;

second voltage generating/maintaining means for generating a second voltage, which is lower than the first voltage, between a second positive electrode and the negative electrode and maintaining the second voltage, the first and second positive electrodes being different from each other; and

first excitation control means for exciting and controlling the electromagnets by one of a first supply current supplied from the second positive electrode to the negative electrode and a first regenerated current regenerated from the second positive electrode to the first positive electrode,

wherein the first excitation control means includes:

a first switch element for connecting and disconnecting the first supply current;

a first control circuit for controlling connection and disconnection of the first switch element; and

a first rectifier element for causing the first regenerated current to flow in the direction of its regeneration.

2. A magnetic bearing device according to Claim 1, further comprising:

a resistor connected at one end to the negative electrode; and

electromagnet current detecting means for detecting the value of one of currents supplied to and regenerated by the electromagnets by flowing the current in the resistor.

3. A magnetic bearing device according to Claim 1, wherein the first control circuit performs cyclic control through PWM control based on a current flowing in the electromagnets.

4. A magnetic bearing device according to Claim 1, wherein the second voltage is half the first voltage.

5. A magnetic bearing device according to Claim 1,

wherein the plural electromagnets are provided, and

wherein the each electromagnet forms at one end a common node, which is kept at the second voltage by the second voltage generating/maintaining means.

6. A magnetic bearing device according to Claim 5, wherein the second voltage generating/maintaining means includes:

a voltage error computing unit for calculating an error between the voltage of the one end of the each electromagnet and a voltage command value; and

a regulator circuit for adjusting the second voltage in accordance with the error calculated by the voltage error computing unit.

7. A magnetic bearing device according to Claim 6, wherein the regulator circuit performs cyclic control through PWM control based on the error.

8. A magnetic bearing device according to Claim 5,

wherein the second voltage generating/maintaining means has a regulator circuit for adjusting the second voltage, and

wherein a current flow is controlled so that a current flowing between the regulator circuit and the one end of the each electromagnet does not exceed a given limit.

9. A magnetic bearing device according to Claim 8, wherein, in the current flow control, a regenerated current flows between the regulator circuit and the one end of the each electromagnet.

10. A magnetic bearing device according to Claim 8, wherein the limit is changed in accordance with an error between the voltage

of the one end of the each electromagnet and the voltage command value.

11. A magnetic bearing device according to Claim 8, wherein the regulator circuit includes:

a choking coil connected to the one end of the each electromagnet;

a third switch element for connecting and disconnecting a current that flows between the choking coil and the negative electrode;

a third rectifier element for causing a current to flow from the negative electrode to the choking coil;

a fourth switch element for connecting and disconnecting a current that flows between the first positive electrode and the choking coil; and

a fourth rectifier element for causing a current to flow from the choking coil to the first positive electrode,

wherein, to raise the voltage of the one end of the each electromagnet, the third switch element is kept disconnected while controlling connection and disconnection of the fourth switch element, and

wherein, to drop the voltage of the one end of the each electromagnet, the fourth switch element is kept disconnected while controlling connection and disconnection of the third switch

element.

12. A magnetic bearing device according to Claim 10, wherein the limit is changed to a larger value as the error increases.

13. A magnetic bearing device comprising:

a rotor;

position control means for controlling at least one of a radial position and an axial position of the rotor by electromagnets;

first voltage generating means for generating a first voltage between a first positive electrode and a negative electrode;

second voltage generating/maintaining means for generating a second voltage, which is lower than the first voltage, between a second positive electrode and the negative electrode and maintaining the second voltage, the first and second positive electrodes being different from each other; and

second excitation control means for exciting and controlling the electromagnets by one of a second supply current supplied from the first positive electrode to the second positive electrode and a second regenerated current regenerated from the negative electrode to the second positive electrode,

wherein the second excitation control means includes:

a second switch element for connecting and disconnecting

the second supply current;

a second control circuit for controlling connection and disconnection of the second switch element; and

a second rectifier element for causing the second regenerated current to flow in the direction of its regeneration.

14. A magnetic bearing device according to Claim 13, further comprising:

a resistor connected at one end to the negative electrode; and

electromagnet current detecting means for detecting the value of one of currents supplied to and regenerated by the electromagnets by flowing the current in the resistor.

15. A magnetic bearing device according to Claim 13, wherein the second control circuit performs cyclic control through PWM control based on a current flowing in the electromagnets.

16. A magnetic bearing device according to Claim 13, wherein the second voltage is half the first voltage.

17. A magnetic bearing device according to Claim 13, wherein the plural electromagnets are provided, and wherein the each electromagnet forms at one end a common node,

which is kept at the second voltage by the second voltage generating/maintaining means.

18. A magnetic bearing device according to Claim 17, wherein the second voltage generating/maintaining means includes:

a voltage error computing unit for calculating an error between the voltage of the one end of the each electromagnet and a voltage command value; and

a regulator circuit for adjusting the second voltage in accordance with the error calculated by the voltage error computing unit.

19. A magnetic bearing device according to Claim 18, wherein the regulator circuit performs cyclic control through PWM control based on the error.

20. A magnetic bearing device according to Claim 17,

wherein the second voltage generating/maintaining means has a regulator circuit for adjusting the second voltage, and

wherein a current flow is controlled so that a current flowing between the regulator circuit and the one end of the each electromagnet does not exceed a given limit.

21. A magnetic bearing device according to Claim 20, wherein,

in the current flow control, a regenerated current flows between the regulator circuit and the one end of the each electromagnet.

22. A magnetic bearing device according to Claim 20, wherein the limit is changed in accordance with an error between the voltage of the one end of the each electromagnet and the voltage command value.

23. A magnetic bearing device according to Claim 20, wherein the regulator circuit includes:

a choking coil connected to the one end of the each electromagnet;

a third switch element for connecting and disconnecting a current that flows between the choking coil and the negative electrode;

a third rectifier element for causing a current to flow from the negative electrode to the choking coil;

a fourth switch element for connecting and disconnecting a current that flows between the first positive electrode and the choking coil; and

a fourth rectifier element for causing a current to flow from the choking coil to the first positive electrode,

wherein, to raise the voltage of the one end of the each electromagnet, the third switch element is kept disconnected while

controlling connection and disconnection of the fourth switch element, and

wherein, to drop the voltage of the one end of the each electromagnet, the fourth switch element is kept disconnected while controlling connection and disconnection of the third switch element.

24. A magnetic bearing device according to Claim 22, wherein the limit is changed to a larger value as the error increases.

25. A magnetic bearing device comprising:

a rotor;

position control means for controlling at least one of a radial position and an axial position of the rotor by a plurality of electromagnets;

first voltage generating means for generating a first voltage between a first positive electrode and a negative electrode;

second voltage generating/maintaining means for generating a second voltage, which is lower than the first voltage, between a second positive electrode and the negative electrode and maintaining the second voltage, the first and second positive electrodes being different from each other;

first excitation control means for exciting and controlling at least one of the plural electromagnets by one of a first supply

current supplied from the second positive electrode to the negative electrode and a first regenerated current regenerated from the second positive electrode to the first positive electrode; and

second excitation control means for exciting and controlling at least one of the electromagnets, excluding the one or more that are excited and controlled by the first excitation control means, by one of a second supply current supplied from the first positive electrode to the second positive electrode and a second regenerated current regenerated from the negative electrode to the second positive electrode,

wherein the first excitation control means includes:

a first switch element for connecting and disconnecting the first supply current;

a first control circuit for controlling connection and disconnection of the first switch element; and

a first rectifier element for causing the first regenerated current to flow in the direction of its regeneration, and

wherein the second excitation control means includes:

a second switch element for connecting and disconnecting the second supply current;

a second control circuit for controlling connection and disconnection of the second switch element; and

a second rectifier element for causing the second

regenerated current to flow in the direction of its regeneration.

26. A magnetic bearing device according to Claim 25, wherein the electromagnets are divided into two groups, one excited and controlled by the first excitation control means and the other excited and controlled by the second excitation control means, so that the amount of current flowing from the first positive electrode to the second positive electrode and the amount of current flowing from the second positive electrode to the negative electrode are made equivalent to each other.

27. A magnetic bearing device according to Claim 25, further comprising:

a first resistor connected at one end to the negative electrode and at the other end to the first switch element;

first electromagnet current detecting means for detecting the value of a current supplied to the electromagnets by flowing the current in the first resistor;

a second resistor connected at one end to the negative electrode and at the other end to the second rectifier element; and

second electromagnet current detecting means for detecting the value of a current regenerated by the electromagnets by flowing the current in the second resistor,

wherein the first electromagnet current detecting means makes

a detection when the first switch element is connected, and

wherein the second electromagnet current detecting means makes a detection when the second switch element is disconnected.

28. A magnetic bearing device according to Claim 26,

wherein the position control means includes:

a first radial positive side electromagnet for controlling the rotor from the radial positive side at a given position in the axial direction of the rotor;

a first radial negative side electromagnet that forms a pair with the first radial positive side electromagnet to control the rotor from the radial negative side;

a second radial positive side electromagnet for controlling the rotor from the radial positive side at a position apart from the first radial positive side electromagnet and the first radial negative side electromagnet; and

a second radial negative side electromagnet that forms a pair with the second radial positive side electromagnet to control the rotor from the radial negative side, and

wherein the first radial positive side electromagnet and the second radial positive side electromagnet are put in different groups, and the first radial negative side electromagnet and the second radial negative side electromagnet are put in different groups.

29. A magnetic bearing device according to Claim 26, wherein the position control means includes:

a radial, X-axis, positive-side electromagnet and a radial, Y-axis, positive-side electromagnet for controlling the rotor from the radial, X-axis positive side and from the radial, Y-axis positive side at given positions in the axial direction of the rotor; and

a radial, X-axis, negative-side electromagnet and a radial, Y-axis, negative-side electromagnet that are respectively paired with the radial, X-axis, positive-side electromagnet and the radial, Y-axis, positive-side electromagnet to control the rotor from the radial, X-axis negative side and from the radial, Y-axis negative side, and

wherein the radial, X-axis, positive-side electromagnet and the radial, X-axis, negative-side electromagnet constitute one group while the radial, Y-axis, positive-side electromagnet and the radial, Y-axis, negative-side electromagnet constitute another group.

30. A magnetic bearing device according to Claim 26, wherein the position control means includes:

an axial positive side electromagnet for controlling the rotor from the axial positive side; and

an axial negative side electromagnet that forms a pair with the axial positive side electromagnet to control the rotor

from the axial negative side, and

wherein the axial positive side electromagnet and the axial negative side electromagnet are put in the same group.

31. A turbo molecular pump comprising the magnetic bearing device according to Claim 1,

wherein the rotor has rotor blades and a rotor shaft placed at the center of the rotor blades, and

wherein the position control means levitates the rotor shaft by a magnetic force.

32. A turbo molecular pump comprising the magnetic bearing device according to Claim 13,

wherein the rotor has rotor blades and a rotor shaft placed at the center of the rotor blades, and

wherein the position control means levitates the rotor shaft by a magnetic force.

33. A turbo molecular pump according to Claim 31, further comprising:

a turbo molecular pump main body having at least the rotor and the position control means; and

a control device having at least the first excitation control means,

wherein the turbo molecular pump main body and the control device are integrated into one.

34. A turbo molecular pump according to Claim 32, further comprising:

a turbo molecular pump main body having at least the rotor and the position control means; and

a control device having at least the second excitation control means,

wherein the turbo molecular pump main body and the control device are integrated into one.